

PATENT SPECIFICATION



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COMPLETE SPECIFICATION.

Improvements in or relating to Cyphering Machines.

I, ALBERT HENKELS, of 26, Barmerstr., Langerfeld, near Barmen, Germany, and of German nationality, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My invention refers to a cyphering device, *i.e.* a device for converting plain words or phrases into a secret or cypher-code and *vice versa*. From the hitherto known cyphering devices with which the conversion of plain language into the secret code and *vice versa* was accomplished by the individual exchange of letter types, *i.e.* in which every letter type of the plain language or of the secret code is converted, the object of the present invention is distinguished essentially by whole words or entire phrases of the open language or a continuous sequence of letters or signs of the secret code being first set and then being transcribed as a whole either into the secret code or *vice versa*, into ordinary language. The adjustment of the sequence of letters or signs of the ordinary language as well as of the secret code is effected by the same type-carriers, and the transcription is effected by turning these type-carriers in such a way that the transcribed writing also appears and may be read off in a suitable place on the same type-carriers namely, in one case instead of the orderly sequence of letters or signs of the ordinary language the senseless arbitrary sequence of letters or signs of the secret code; in the other case instead of the senseless arbitrary sequence of letters and signs of the secret code the ordinary sequence of letters and signs of plain language.

In the drawings affixed to the specification and forming part thereof two modifications of a device embodying my invention are illustrated by way of example.

Figs. 1 to 3 representing the simplest form in order to illustrate clearly the essence of the invention, while

Figs. 4 to 15 disclose a device intended for practical use. In the drawings

Fig. 1 is a vertical longitudinal section,

Fig. 2 a plan view with the cover of the casing removed and

Fig. 3 is a cross section.

1 is the casing consisting of a rectangular box. Inside this case a shaft 2 and four spindles 3, 4, 5 and 6 are supported in parallel one behind the other. The shaft carries at the end protruding through the side of the casing, a crank and may be turned by means of this crank, whereas the spindles 3, 4, 5, 6 are preferably secured against rotation in a suitable manner. Each of the four spindles 3, 4, 5, 6 carries an equal number of discs which can turn freely on the spindles, but which cannot move laterally relatively to spindles carrying them. These discs form the carriers of the types; at the circumference of the discs the letters of the alphabet, numbers and other signs are arranged at equal distances apart.

Connected rigidly to each of the discs 8 placed upon the spindles 4, 5, 6 is a gear wheel 9; the gear wheels of the discs 8 placed on shaft 4 mesh with the adjacent gear wheels of the discs on the spindle 5, these latter again with the adjacent gear wheels 9 of the discs on spindle 6. With each disc 8 on spindle 3, however, two gear wheels 10 and 11 are rigidly connected, gear wheels 10 meshing with gear wheels 9 on spindle 4, whereby each four discs lying one behind the other are coupled together, whereas those discs placed on a common spindle side by side *i.e.* those discs situated in the same row, are independent of one another. The gear wheels 11 mesh with the gear wheels 12 which are keyed to the shaft 2 so that, by turning the shaft 2, all type carriers or discs 8 may be turned together. The gear wheels of the four rows of discs may be disengaged by a lateral movement, so that all type discs may be set independently of each other. To this effect the discs 8 are

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secured at the proper distance from one another by means of small spacing tubes 13 placed upon the spindle. The spindles 3 and 5 together with the discs and gear wheels mounted upon them, are arranged so that they can slide laterally inside the longitudinal walls of the casing 1, in order that they may be moved together with the discs and gear wheels mounted upon them, relatively to the shaft 2 and the spindles 4 and 6, as also to the discs and gear wheels mounted upon the latter. In order to facilitate the lateral movement, the spindles 3, 5 are provided with handles or knobs 14 at one end, whereas at the opposite ends which are provided with a collar, a bolt or lever 15, mounted outside the casing, is provided for holding the spindles in position when the gear wheels are in mesh.

The setting of the type carriers or discs 8 is effected by keys 17 guided in the cover of the casing 16, the upper ends of these keys 17 being provided with a push button 18 whereas their lower ends carry the pawls 19 which, when the keys 17 are pressed down, engage the gear wheels 9 of the discs 8, thereby turning them step by step. The keys are returned into the upper limiting position every time after having been pressed down, and are held in this position by means of the springs 20. The distance through which the pawls 19 travel is such that every time the push buttons 18 are pressed down, the disc 8 operated by any particular button is moved over by one letter-type. The pawls indicated in the drawing only permit of a rotation of the discs 8 in one direction but this switching mechanism may, of course, also be arranged in such a way that the discs may be turned either in one or the other direction. Spring catches 21 engage the gaps between the gear teeth of the gear wheels from below, thus locking the discs 8 in the position once taken up, without however, impeding their further operation.

The gear wheels 10 of the discs 8 mounted on the spindle 3 as also the gear wheels 12 on the driving shaft 2 are not clogged regularly all over, but their rims are provided with interruptions in the spacing of the gear teeth, the length and disposition of these gear interruptions being different on the various gear wheels. By this arrangement the discs mounted on one common spindle, *i.e.* in a row adjacent to each other, are turned through different angles during the rotation of the driving shaft 2 so that each one of the discs 8 arranged side by side, is placed in a different position.

Above the discs 8 four rows of windows 65 are provided in the casing 16 through

which the letter types which happen to be on top of the discs 8, become visible. Outside the casing, along one longitudinal wall, markings 23 have been provided adjacent to the crank, which serve as indicators for the initial position of the crank and for the amount through which the crank is turned.

The row of discs mounted on the spindle 3 serves for setting the key or pass-word, which preferably contains as many letters as there are discs on this spindle whereas the rows of discs on the spindles 4, 5, and 6 serve for the adjustment and transcription of the message to be transmitted.

The transcription of plain language into the secret code is effected in the following manner.

After the gear wheels of all the discs have been disengaged by an axial movement of the spindles 3 and 5, the pass-word previously agreed upon is set at the discs of the spindle 3 by these discs being turned by means of the keys 17 and the pawls 19 until the corresponding letters appear in the windows 22. Now, the message to be transmitted in plain language, consisting of words, phrases, and numbers is set on the discs 4, 5, and 6. This is effected by the discs being turned by means of the keys 17 and the pawls 19 until the desired sequence of letters and numbers appears underneath the respective windows. By moving the spindles 3 and 5 in the opposite direction all gear wheels are now brought back into mesh, whereupon crank 7, which previous to the re-engagement of the gear wheels had been placed into a pre-arranged initial position, is turned through a certain angle or a number of times previously agreed upon. In this manner the discs 8 of the spindles 4, 5 and 6 are subjected to an irregular adjustment through the intermediary of the interrupted spur rims of the gear wheels 12 and 10, so that a senseless sequence of letters and numbers appears below the windows 22, which constitutes the desired secret code. This is transmitted to the receiver of the message.

The de-cyphering of the secret code, *i.e.* its transcription into plain language, is effected by means of an identical machine in the following manner:

First all gear wheels are disengaged by an axial movement of the spindles 3 and 5, whereupon the crank 7 is moved into the pre-arranged initial position and the pass-word previously agreed upon is set by the row of discs on the spindle 3. After the gear wheels have been brought to mesh, the crank 7 is moved through the pre-arranged angle or turned as many times as has previously been agreed upon, and all gear wheels are again disengaged

by the lateral movement of the spindles 3 and 5. Now the sequence of letters and signs of the secret code message is set by the type discs on the spindles 4, 5 and 6.

5 After all gear wheels have been brought into mesh again, the crank 7 is returned into its initial position, whereby the type-discs of the spindles 4, 5 and 6 are moved by the same amount but in opposite direction to the movement effected during the transcription of the plain language message into secret code. Thereby the orderly sequence of letters and signs of the plain language message is caused to appear below the windows 22 of the discs 8 on the spindles 4, 5 and 6 in place of the senseless sequence of letters and signs *i.e.* the message may be read off in plain language through the windows 22.

20 The de-cyphering of the secret code, as is obvious, is only possible to a person possessing a machine which is identical with that of the sender of the message and who, moreover, knows the pre-arranged initial position of the crank, as also the angle through which the crank is to be turned or the number of revolutions, and finally, the key or pass-word previously agreed upon. In this manner, the unauthorised de-cyphering of the message even by a person in possession of a machine, is rendered absolutely impossible.

35 As with the device disclosed in Figs. 1 to 3, the discs placed one behind the other on the spindles, 4, 5, and 6 are turned through the same angle every time for a complete rotation of the mutilated gear wheels 12, it will be necessary, in order to avoid the danger of a possible de-cyphering of the secret code by means of the regularly recurring types and signs, to choose at least on the discs of the spindles 6 a sequence of letters different from that on the discs of the spindles 4 and 5. The sequence of letters on the discs of the spindles 4 and 5, however, may be the same, as these discs, although being turned the same amount, are turned in opposite direction. In the same manner the sequence of letters on the discs placed side by side on a common shaft may be the same, as each one of these discs placed side by side in one row is moved through a different angle. There is, consequently, a maximum degree of security against unauthorized de-cyphering of the secret message, as it never happens that certain signs of the secret code correspond to equal signs in plain language.

60 However, in order to permit of turning the discs placed in one row one behind the other, each through a different angle, the discs mounted on spindle 4 may be coupled to those on spindle 5, and the

latter again to those mounted on spindle 6, through the intermediary of spur gears, the toothed rims of which are irregularly interrupted as is the case with the device illustrated in Figs. 4 to 15. For the practical execution of the apparatus it is advisable in order to avoid mistakes in transcribing the messages, to make provision for preventing an unintentional turning of the driven wheels and of the type discs connected thereto, whenever they are not taken along by the driving gears owing to the interruptions in the spur rims. These provisions may be of a nature as described in the second example.

The arrangement intended for practical use is represented in Figs. 4 and 5 in longitudinal cross section,

Fig. 4 showing the gear wheels in mesh with each other whereas

Fig. 5 represents the same gear wheels disengaged.

Fig. 6 is a plan view,

Figs. 7 and 8 disclose the cutting-in and out devices, respectively, of the gear mechanism in two different positions, whereas

Figs. 9 to 12 show the gear mechanism of several type discs, one behind the other, in side elevation and top view, in two different angular positions of the wheels, respectively.

Figs. 13 and 14 are a longitudinal section through part of the machine, as also a plan view from above, respectively, with the operating mechanism disengaged.

Fig. 15, represents the progressive connection or adjustment, respectively, of the type carriers or discs.

In the arrangement disclosed in Figs. 4 to 15, 1 again represents the casing of the machine, in which the shaft 2 and five spindles 3, 4, 5, 6 and 24 are arranged in parallel, one behind the other. The shaft 2 serves as the driving shaft; at its one end protruding from the casing through the slot 60, it carries the hand-crank 7, whereas on each of the spindles 3, 4, 5, 6 and 24 an equal number of type carriers or discs has been arranged in such a manner as to turn loose on the spindles, but immovable laterally. Each disc is rigidly connected to two gear wheels 25, 26 one of which (25) is provided with a full toothed spur-rim whereas the other one, 26, has an interrupted toothed spur rim, *i.e.* one provided with irregular groups of teeth. The full and the interrupted gear wheels fixed to the discs 8 placed one behind the other, are shifted in their respective positions relatively to each other so that for instance, on spindle 3 the full spur gears 25 are placed to the right, and the inter-

rupted gear wheels 26 to the left of the discs 8. On the spindle 4, however, the interrupted gear wheels are placed to the right and the full gear wheels to the left of the discs 8, and so on. In this way, one full gear wheel will always be opposite an interrupted one. The gear wheels are not in direct mesh with each other but are coupled by means of pinions 32 mounted rotatably on the intermediate spindles 27, 28, 29, 30, 31 but in a manner that they cannot be shifted laterally. The pinions placed one behind the other in the longitudinal direction of the machine are arranged alternately to the right and to the left of the discs (Fig. 10), so that the interrupted gear wheels on spindle 3 may be coupled to the full gear wheels on spindle 4, while the interrupted gear wheels on spindle 4 may be coupled to the full gear wheels on spindle 5, and so on. Gear wheels 33 mounted on the driving shaft 2 mesh with the full gear wheels on the spindle 3. When the crank shaft 2 is turned, the gear wheels 33 drive the full gear wheels 25 of the discs 8 on the spindle 3 which, in turn, by means of their interrupted gear wheels 26, drive the full gear wheels of the discs 8 on the spindle 4 through the pinion 32, and so on. In this manner, not only each of the discs 8 placed on a common spindle side by side is turned through a different angle, but also all discs arranged one behind the other, will be subject to a different angular motion. As only the discs on the spindles 4, 5, 6 and 24 serve for transcribing the message, and the discs on spindle 3 for setting the pass-word, in order to change the initial position of the interrupted gear wheels of these discs, the latter discs may also be turned in common through the same angular distance. Therefore, the gear wheels 33 need not be provided with interruptions such as described in connection with the gear wheels 12 of Figs. 1 to 3, but may be fitted with full spur rims as represented in Figs. 4 and 5.

During the turning of the discs with the object of transcribing the sequence of letters or signs set on the machine into secret cypher or *vice versa*, the pinions 32 are to serve at the same time for locking the driven full gear wheels 25 and therewith also the discs 8 in their respective positions, wherever the pinions 32 by virtue of the interruptions in the toothed rims of the driving gear wheels 26 are out of mesh with the latter *i.e.* when the driving gear wheels are running idle. To this effect one half of the face of the pinions 32 is provided with full teeth, whereas on the other half of the face, each second tooth has been removed.

(Figs. 9—12). This means that these pinions are provided, so-to-say, with two rows of teeth corresponding as regards the position of the teeth, one of which only possesses half as many teeth as the other. At the places where the toothed rims of the driving gear wheels 26 are interrupted, segments 34 have been provided, connecting the groups of teeth, and forming a continuation of the pitch circle. These segments extend over the part of the face of the tooth opposite that half of the pinion 32 which only possess half the number of teeth. As long as one group of teeth of the driving wheels is in operation (Figs. 9 and 10) both toothed rims of the pinion mesh with the driving wheel 26, as also with driven wheel 25. Whilst the driving wheel 26 is running idle, *i.e.* when the pinion is placed opposite an interruption in the toothed rim of the latter, the segment connecting the groups of teeth of the driving wheel engages the gap provided on one half of the pinion by omitting every other tooth (Figs. 11 and 12); thereby the pinion is prevented from turning. As, however, the pinion meshes permanently with the neighbouring full gear wheel, this latter is likewise locked together with its respective disc, while the driving wheel is running idle, whereby mistakes in the transcription of a sequence of letters or signs due to an unintentional movement of one of the discs, are effectively guarded against. Moreover, the locking of the pinions assures at all times the correct re-engagement of the gear teeth of the interrupted wheels, both during the forward movement of the latter as also during the reverse rotation.

The cutting-out of the gear mechanism is not accomplished by an axial movement of part of the spindles but by a shifting of the spindles in transverse direction. To this effect the spindles 3, 4, 5, 6, 24 are each supported not in the walls of the casing, but in carriages comprising each a pair of laterally disposed cheeks 36 which are guided in grooves 35 provided in the longitudinal walls of the casing 1. These cheeks 36 at the same time carry the spindles 27, 28, 29, 30 and 31, the arrangement being such that each one of the spindles 3, 4, 5, 6, 24 is attached to one pair of checks, together with the spindles 27, 28, 29, 30, and 31 located behind the former. Except for the cheeks carrying the spindles 5 and 29 which are held in a fixed position on the walls of the casing each pair of cheeks is connected rigidly together by means of the spindles, as also by a number of transverse tie-rods (not shown in the drawings), thus forming a sliding frame or carriage which may

be moved in longitudinal direction of the casing in such a way as to allow the sets of gears being brought out of engagement by shifting the pairs of cheeks in opposite directions. This shifting of the pairs of cheeks is effected by the aid of two slide rods 37, guided in slots in one of the longitudinal walls of the casing (Figs. 7 and 8). The innermost ends of these slide rods carry rollers 38 which engage in radial slits 39 of a crank or eccentric disc 40 supported along the wall of the casing. This disc 40 may be turned by means of a hand crank 41 connected thereto. The slide rods are provided with holes 42 and with longitudinal slots 43 which engage pivots 44 (Fig. 13) provided on the sliding cheeks. The pivots of the cheeks carrying the spindles 4 and 6 engage the slots 43; the pivots of the cheeks carrying the spindles 3 and 26, however, engage the holes 42. If the disc 40 is turned in counter-clockwise direction (Fig. 8), the two pairs of cheeks containing the spindles 3—27 and 24—31 are carried along first, and after the latter have moved through a certain distance, the pairs of cheeks containing the spindles 4—28 and 6—30 are carried along, *i.e.* the pairs of spindles located in front and behind the fixed spindles 5—29 are moved away from this latter pair of spindles as also from each other in opposite directions. In this manner all pinions 32 have been brought out of engagement with the full gear wheels 25 placed behind, thus uncoupling the discs 8 located one behind the other (Figs. 5 and 13). The coupling-up of the system of gears is effected by the opposite rotation of the disc 40, whereby the spindles are moved in the opposite manner to what had been done before, until all gear wheels are again in mesh. The driving shaft 2 may likewise be supported in a pair of cheeks which may slide in longitudinal direction inside the casing 1. However, it may also be supported in the pair of cheeks carrying the spindles 3 and 27, as represented on the drawing, the unclutching of its gear wheels from the gears 25 of the spindles 3 being in this case affected by a movement of the driving shaft 2 in axial direction. For preventing an unintentional turning of the type discs whilst the gear wheels are unclutched, the discs 8 are locked by means of springs 45, pressing against them from below. (Figs. 2 and 13.) The springs 45 are preferably fastened to shafts 46 resting in the respective pair of cheeks 26 and carrying each one control lever 47, which is acted upon by a pusher-rod 48, one end of which is linked to the lever 47, the other end being attached to the casing 1. The arrangement of the

pusher rods in this case is such that during the movement of the pairs of cheeks with the object of uncoupling the system of gears, the springs 45 are pressed against the type-discs 8 by turning the shafts 46. During the opposite movement of the cheeks with the object of re-engaging the system of gears, however, these springs are moved away from the discs 8, *i.e.* put out of action.

The windows 22 are provided in the rails 49 connecting the pairs of cheeks 36 on top, these rails taking part in the movement of the spindles. Owing to the arrangement of the intermediate gear wheels 32 it is possible to make the type discs 8 as large as, or even larger than the gear wheels 25, 26 in order that the types may be placed close below the windows, so that the type or letter which happens to be on top is directly below the window. For closing the spaces remaining between the rails 40 covering laths 50 extending over the edges of the rails 40, have been provided which are fastened to the walls of the casing 1 in such a way as not to impede the movement of the rails 49 during the connection and disengagement of the system of gears.

For rotating any individual type disc 8 in order to see the pass-word and the message to be transmitted, keys 17 have again been provided which have push buttons 18 fitted to the tops. With the arrangement according to Figs. 4—15 the lower, off-set ends of these keys are guided in vertical holes provided in flat rods 51, connecting the cheeks 36, 36 of each pair of cheeks, whereas they are guided on top, on the spindles 27, 28, 29, 30, 31 by means of longitudinal slits 52. In order to permit of turning the type discs 8 backward as well as forward, the keys 17 carry two pawls 19 and 19^a arranged in opposite directions relatively to one another, one of which (19) engages the full gear wheels 25 from the top, the other one from below. The keys 17 may be pressed down or raised by means of the buttons 18. As a rule they are kept midway between the top and bottom position by means of a two-legged spring 53 attached to a rod 54 connecting the two cheeks 36, 36 and supported in its half-way position inasmuch as the legs of the spring 53 press from above and below against a pivot 56 attached to the key 17. The switching pawls 19 and 19^a, which are again acted upon by springs 57, 57^a are supported in the half-way position of the key 17 by means of transverse rods 58, 58^a so that in this position they cannot engage the teeth of the gears 25. If, however, the key 17 is either raised or lowered, one or the other of the pawls 19

and 19^a will slide either above or below the rod 58 or 58^a, thus engaging the gear teeth of the gear wheel 25 whereby this gear wheel and the respective disc 8 connected thereto are switched round by one type in one or the other direction. A separate operating device is provided for each type disc.

The operation of the device according to Figs. 4 and 5 is essentially the same as with the arrangement according to Figs. 1 to 3. After the system of gear wheels has been uncoupled in the manner already described, the discs 8 on the spindle 3 are first adjusted for the pass-word selected; whereupon on the spindles 4, 5, 6, 24 the plain-language message to be transcribed, is set. After the system of gears has been brought back into mutual engagement, the crank 7 is given a pre-arranged number of turns, thus effecting the conversion of the plain language message into secret code. The decyphering of the message also takes place in the manner described in respect of the example illustrated in Figs. 1 to 3. As the crank shaft 2 carried full gear wheels, a distinct initial position of the crank shaft is not required; only the number of turns of the crank and the pass-word need previously be agreed upon. Also in this case the security is very great, as by the adjustment of another pass-word at the discs of the spindle 8 the initial position of the driving gear wheels 26 on this spindle may be changed in any desired manner whereby, in combination with the selection of a different number of turns of the crank, an infinite number of variations is rendered possible. The arrangement of the types or letter signs may be the same on all the discs, as also those discs located one behind the other are each turned through a different angle.

Of course this invention is not confined to the arrangements illustrated by way of example. There are many other combinations possible in which this invention may be carried into effect without departing from the spirit of my invention. More especially, the machine may be provided with a printing device in order to permit of printing the message directly in plain language, as also in cypher-code, as may be desired.

I am aware that it has been proposed, in cyphering machines whose mode of operation differs from that of the present machine, in one case, to provide three independently rotatable cyphering members, such as tables, plates or drums, which could be coupled by adjustable gearing to a common shaft, and, in another case, to provide two parallel rows of independently rotatable cyphering discs

each fast on a toothed wheel and so mounted that after the independent adjustment of the discs axial shift of one row couples the two rows, and I therefore make no claim to either of these arrangements, *per se*.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A cyphering machine wherein whole words or entire phrases of the open language or a continuous sequence of letters or signs of the secret code are or is first set and then transcribed as a whole into the secret or *vice versa* into ordinary language, this being effected by the provision of a number of type carriers (*e.g.* letter-carrying discs) which are arranged side by side and one behind another in a number of rows and which, on the one hand, can be rotated independently of one another in order to set the sequence of letters to be converted, and, on the other hand, can be coupled with a common driving spindle by means of gear wheels fast on said carriers in order to change the sequence of letters by commonly rotating the type carriers, the rotation of the type carriers being effected by means of gear wheels which are provided with interruptions in the spacing of the gear teeth (*e.g.* irregular gaps among the teeth) differing on different wheels, in order to displace the type carriers through different angles.

2. A cyphering machine according to Claim 1, characterised by this, that between the type carriers serving for conversion of the sequence of letters and the common driving spindle, a further row of rotatable type carriers is arranged, each of which is provided with a fully toothed wheel and a gapped toothed wheel and which, on the one hand, may be adjusted independently of one another to exhibit a pass or key word, and, on the other hand, may be coupled by means of their fully toothed wheels to the gear wheels of the driving shaft and by means of their gapped toothed wheels to the gear wheels of the said type carriers for word-sequence conversion.

3. A cyphering machine according to Claims 1 and 2 characterised by the type carriers which are arranged one behind another being coupled together by means of fully toothed wheels and by the type on said carriers being arranged in varying sequence.

4. A cyphering machine according to Claims 1 and 2, characterised by a number of the spindles which carry the type carriers being displaceable axially, in order to put the gear wheels out of mesh

for the purpose of adjusting the type carriers.

5. A cyphering machine according to Claims 1 and 2, characterised by the type carriers which are arranged one behind another, being coupled together by means of pairs of gear wheels, each pair consisting of a fully toothed wheel and a gapped toothed wheel, in order to be able to shift through different angles not only the type carriers arranged side by side but also those arranged one behind another.

6. A cyphering machine according to Claims 1, 2 and 5, characterised by the, in part, fully and, in part, gapped toothed wheels of the type carriers arranged one behind another being coupled by means of intermediate wheels which on one half-width of their rims have only half the number of teeth existing on the other half, the groups of teeth on the wheels with interrupted teeth being connected by means of segments which constitute a continuation of their addendum-circle and extend over half the width of the wheel and which, during idle operation of the gapped wheels, engage in gaps in the pinions and thereby safeguard from turning both the intermediate wheels and the fully toothed wheels meshing with them.

7. A cyphering machine according to Claims 1 and 2 characterised by the spindle of the type carriers being located in frames or slides shiftable transversely to said spindles, so that, by transversely shifting the frames or slides, the gear coupling the type carriers may be disengaged.

8. A cyphering machine according to Claims 1, 2 and 6, characterised by the slides containing the spindles of the type carriers being displaced by means of two slide rods which are shiftable in either direction by means of a crank disc provided in part with apertures and in part with longitudinal slots, the latter being engaged by pins mounted in the slide or frame.

9. A cyphering machine according to

Claims 1, 2, 6 and 7, characterised by windows being formed in slidable portions of the casing cover, which portions are connected to the frames or slides journalling the type carrier spindles and share the displacement of said frame.

10. A cyphering machine according to Claims 1 and 2, characterised by the type discs being each adjusted by means of a vertically reciprocable key rod, which by means of a two-armed spring is held at middle height and carries two pawls operating in contrary directions and disengaged in the middle position of the key rod, which pawls may be put into engagement with the full gear rim of the type carrier by depressing or elevating the key rod as required, in order to feed said gear in one direction or the other.

11. A cyphering machine according to Claims 1 and 2, characterised by this, that when the pass word and the sequence of letters for conversation have been set the type carriers are held secure against accidental rotation by means of brake-springs, which are mounted on a common spindle for each row of discs, this spindle being journalled in the slide or frame containing the particular spindle for the type carriers and being controlled by means of a control lever and a thrust rod secured to the casing of the machine at the time the frame or slide is displaced, the control being such that when the gears are disengaged the brake springs are pressed against the type carriers, and when the gears are re-engaged said springs are thrown out of action.

12. A cyphering machine, constructed or operating substantially as described, with reference either to Figs. 1—3 or Figs. 4—15 of the accompanying drawings.

Dated this 14th day of July, 1921.

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W.C. 2.

Fig. 1

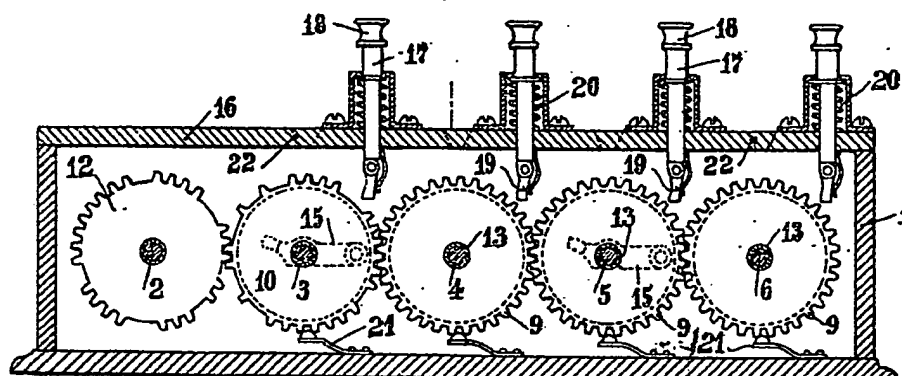


Fig. 2

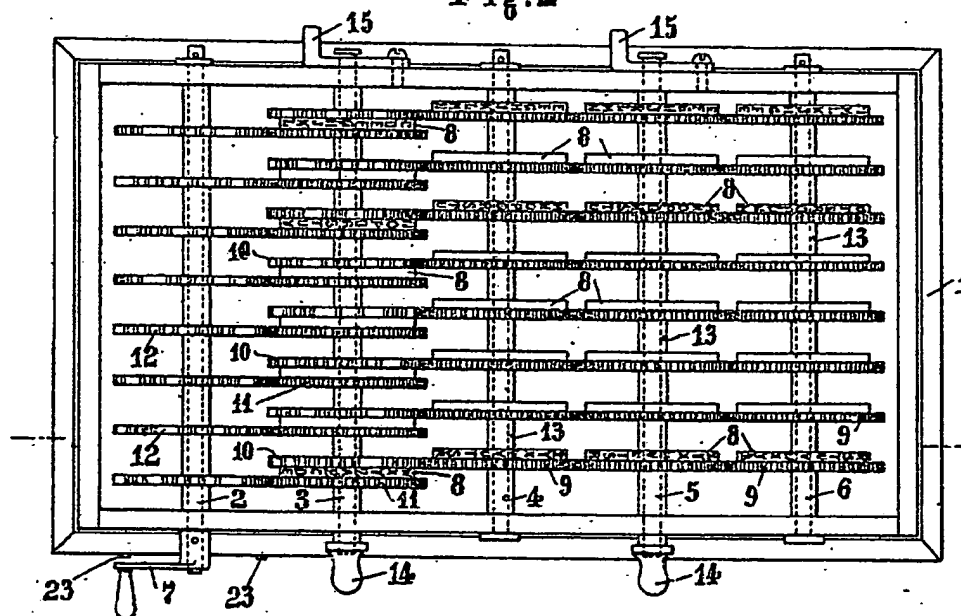
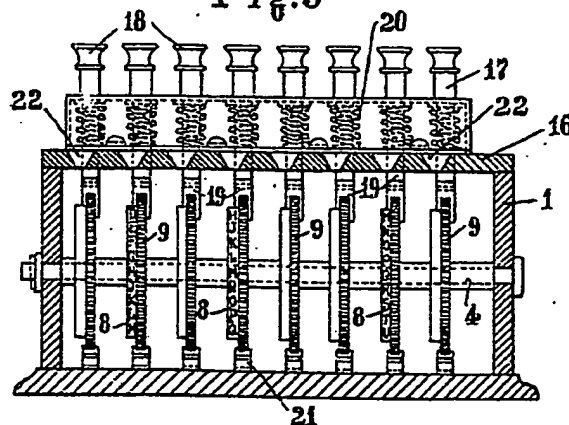


Fig. 3



[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 4

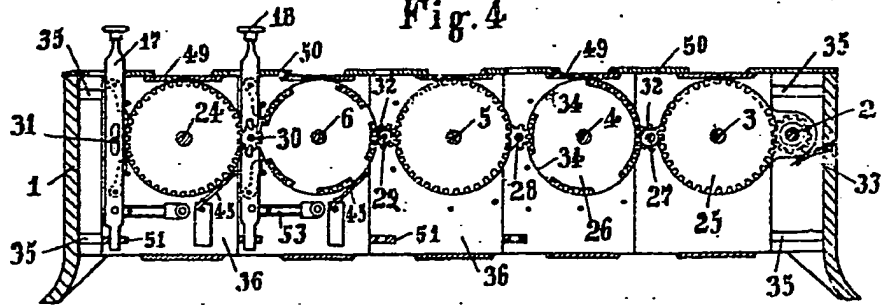


Fig. 5

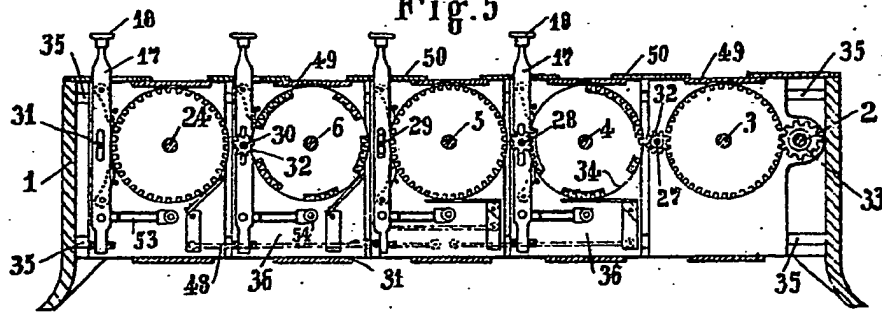
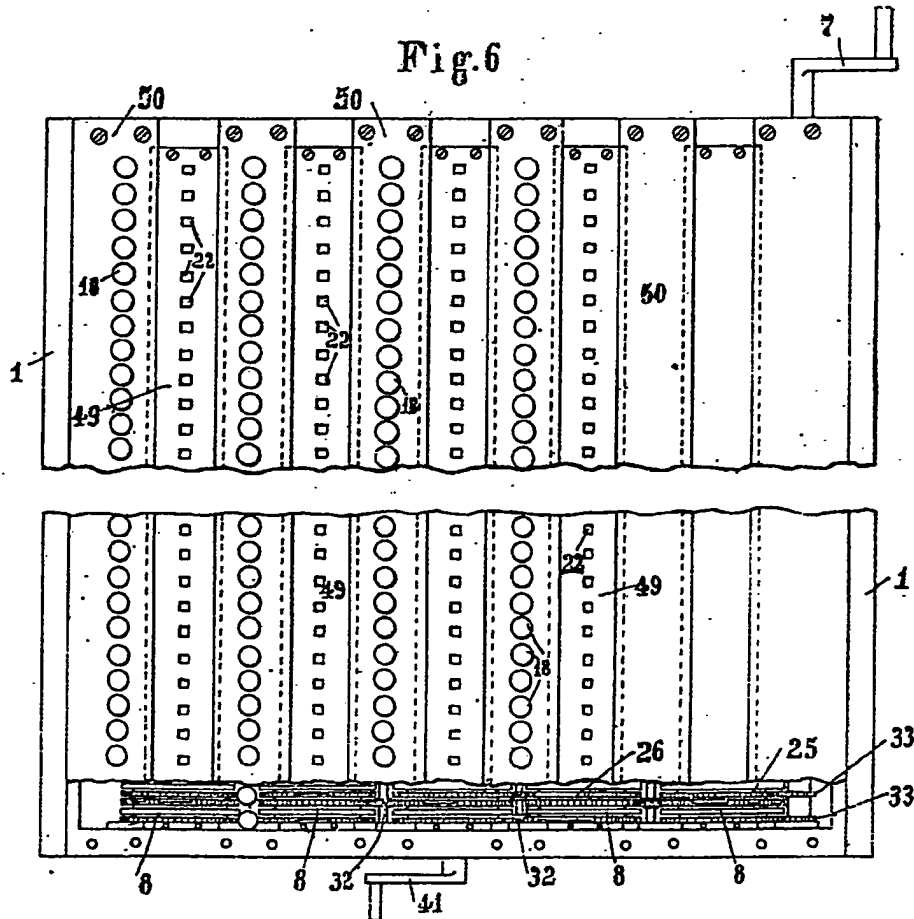


Fig. 6



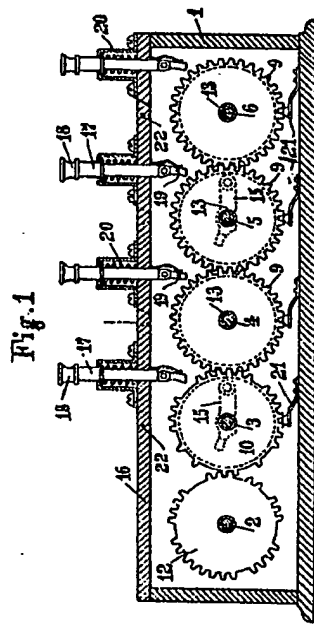


Fig. 1

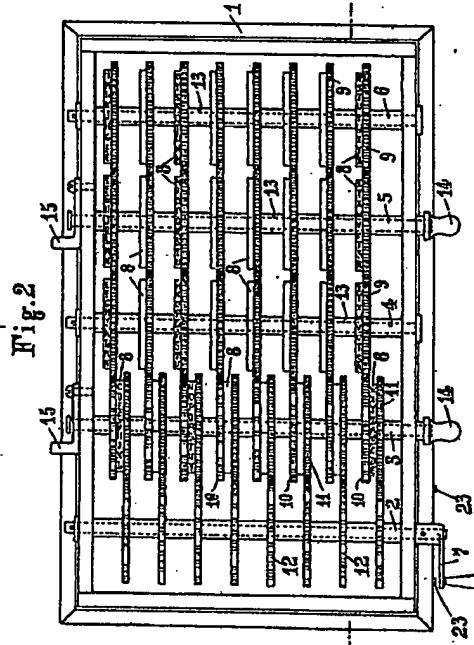


Fig. 2

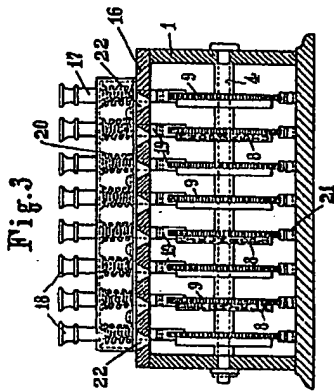


Fig. 3

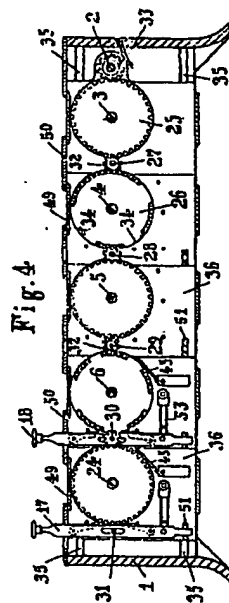


Fig. 4

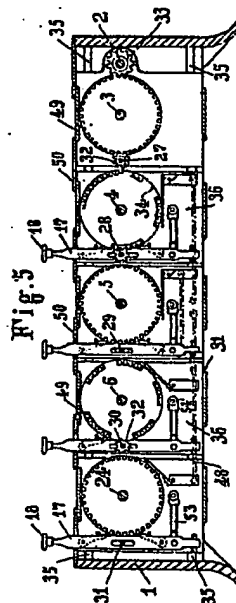


Fig. 5

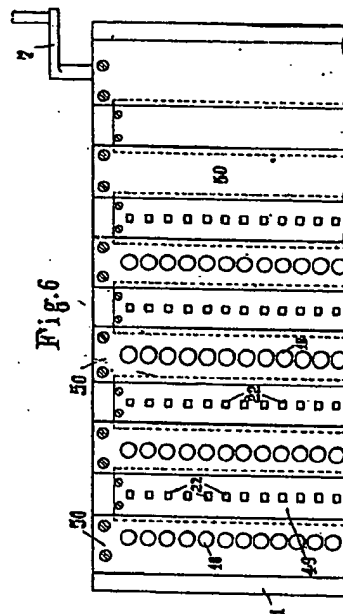
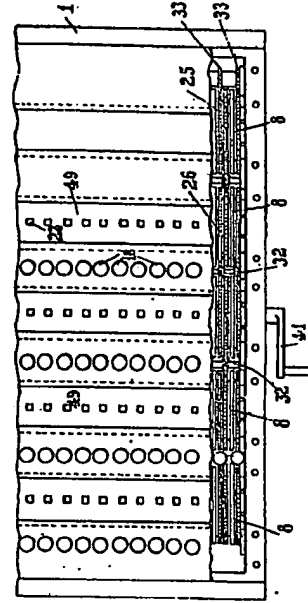


Fig. 6



[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 7

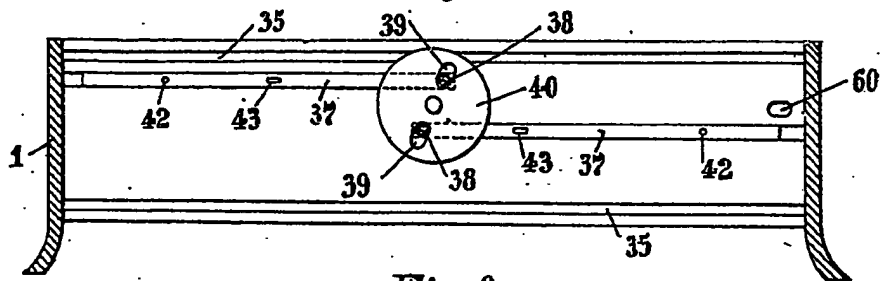


Fig. 8

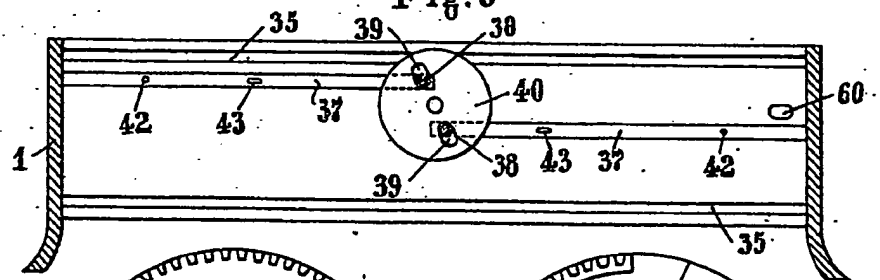


Fig. 9

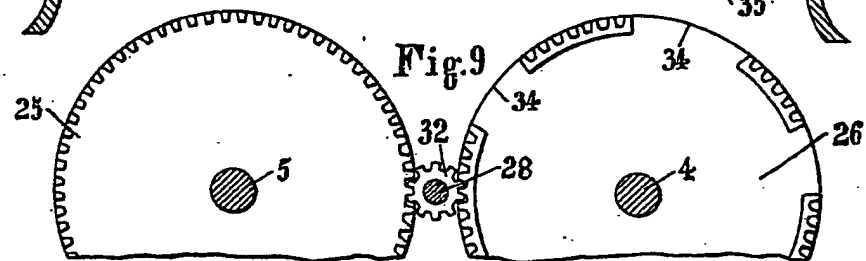


Fig. 10

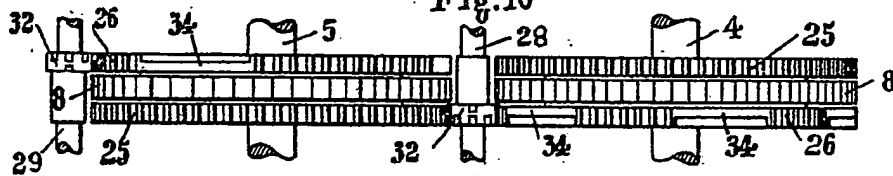


Fig. 11

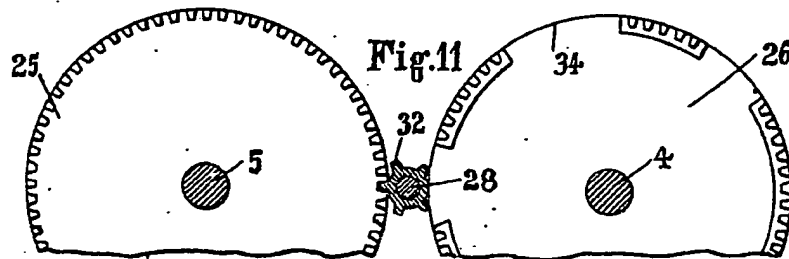
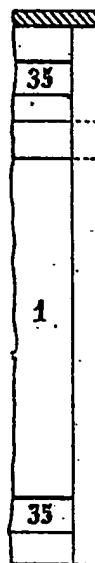
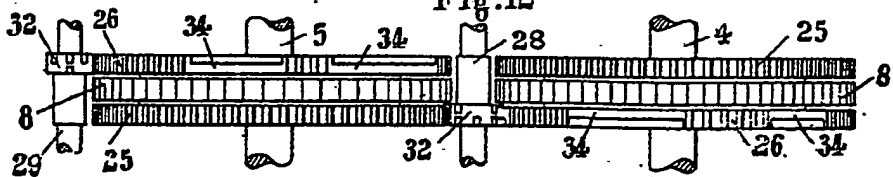


Fig. 12



[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 13

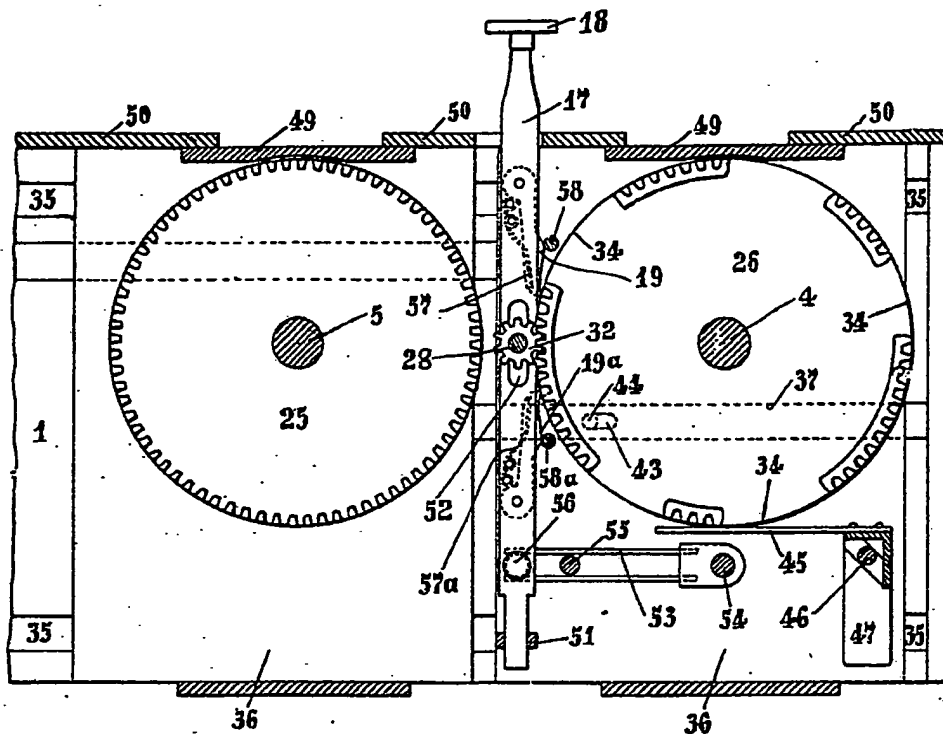


Fig. 14

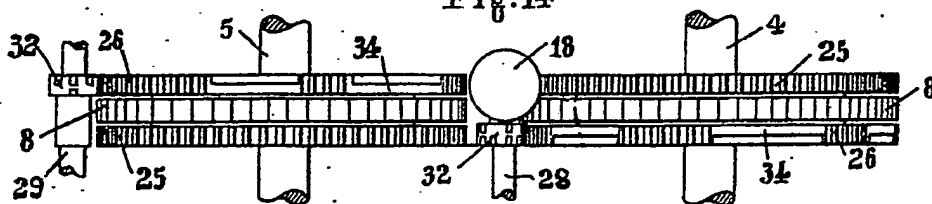


Fig. 15

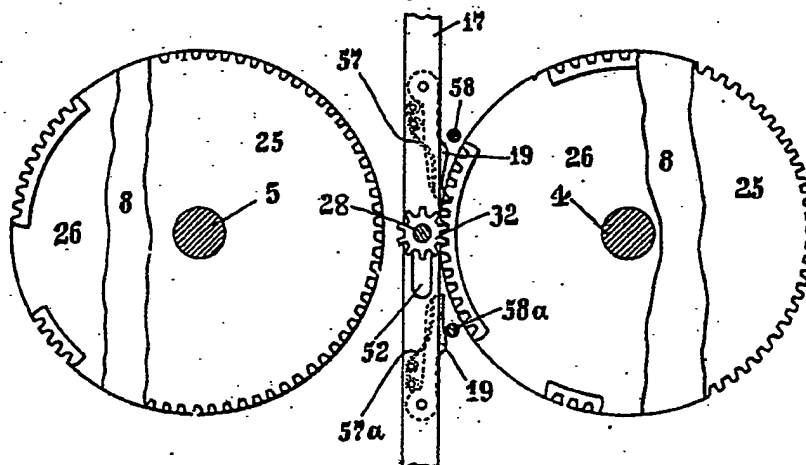


Fig. 7

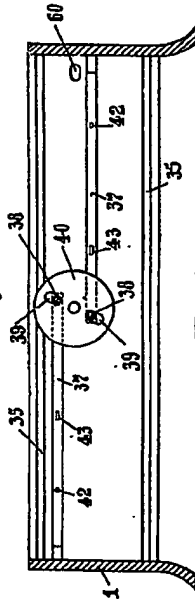


Fig. 8

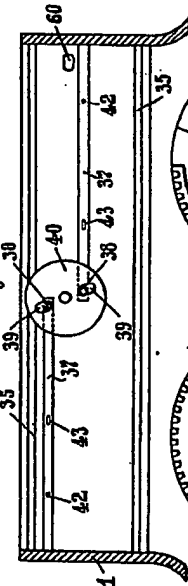


Fig. 9



Fig. 10

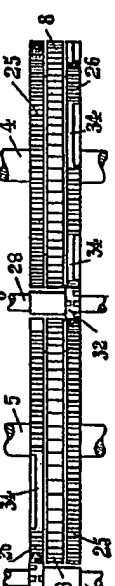


Fig. 11



Fig. 12

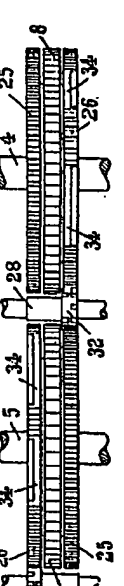


Fig. 13

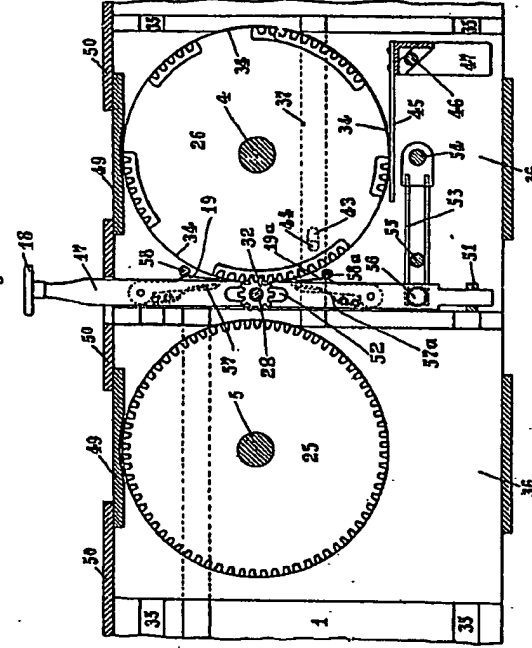


Fig. 14

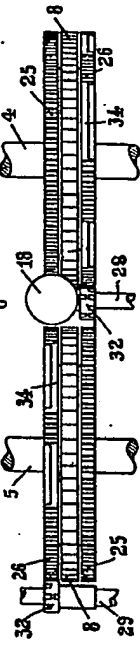
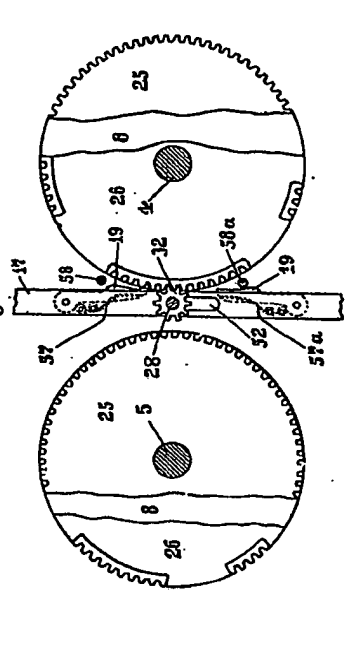


Fig. 15



[This Drawing is a reproduction of the Original on a reduced scale]

PATENT SPECIFICATION



Application Date : July 14, 1921. No. 19,076 / 21.

187,312

Complete Accepted : Oct. 16. 1922.

COMPLETE SPECIFICATION.

Improvements in or relating to Cyphering Machines.

I, ALBERT HENKELS, of 26, Barmerstr., Langerfeld, near Barmen, Germany, and of German nationality, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My invention refers to a cyphering device, *i.e.* a device for converting plain words or phrases into a secret or cypher-code and *vice versa*. From the hitherto known cyphering devices with which the conversion of plain language into the secret code and *vice versa* was accomplished by the individual exchange of letter types, *i.e.* in which every letter type of the plain language or of the secret code is converted, the object of the present invention is distinguished essentially by whole words or entire phrases of the open language or a continuous sequence of letters or signs of the secret code being first set and then being transcribed as a whole either into the secret code or *vice versa*, into ordinary language. The adjustment of the sequence of letters or signs of the ordinary language as well as of the secret code is effected by the same type-carriers, and the transcription is effected by turning these type-carriers in such a way that the transcribed writing also appears and may be read off in a suitable place on the same type-carriers namely, in one case instead of the orderly sequence of letters or signs of the ordinary language the senseless arbitrary sequence of letters or signs of the secret code; in the other case instead of the senseless arbitrary sequence of letters and signs of the secret code the ordinary sequence of letters and signs of plain language.

In the drawings affixed to the specification and forming part thereof two modifications of a device embodying my invention are illustrated by way of example.

Figs. 1 to 3 representing the simplest form in order to illustrate clearly the essence of the invention, while

Figs. 4 to 15 disclose a device intended for practical use. In the drawings

Fig. 1 is a vertical longitudinal section,

Fig. 2 a plan view with the cover of the casing removed and

Fig. 3 is a cross section.

1 is the casing consisting of a rectangular box. Inside this case a shaft 2 and four spindles 3, 4, 5 and 6 are supported in parallel one behind the other. The shaft carries at the end protruding through the side of the casing, a crank 7 and may be turned by means of this crank, whereas the spindles 3, 4, 5, 6 are preferably secured against rotation in a suitable manner. Each of the four spindles 3, 4, 5, 6 carries an equal number of discs which can turn freely on the spindles, but which cannot move laterally relatively to spindles carrying them. These discs 8 form the carriers of the types; at the circumference of the discs the letters of the alphabet, numbers and other signs are arranged at equal distances apart.

Connected rigidly to each of the discs 8 placed upon the spindles 4, 5, 6 is a gear wheel 9; the gear wheels of the discs 8 placed on shaft 4 mesh with the adjacent gear wheels of the discs on the spindle 5, these latter again with the adjacent gear wheels 9 of the discs on spindle 6. With each disc 8 on spindle 3, however, two gear wheels 10 and 11 are rigidly connected, gear wheels 10 meshing with gear wheels 9 on spindle 4, whereby each four discs lying one behind the other are coupled together, whereas those discs placed on a common spindle side by side *i.e.* those discs situated in the same row, are independent of one another. The gear wheels 11 mesh with the gear wheels 12 which are keyed to the shaft 2 so that, by turning the shaft 2, all type carriers or discs 8 may be turned together. The gear wheels of the four rows of discs may be disengaged by a lateral movement, so that all type discs may be set independently of each other. To this effect the discs 8 are

[Price 1/-]

secured at the proper distance from one another by means of small spacing tubes 13 placed upon the spindle. The spindles 3 and 5 together with the discs and gear wheels mounted upon them, are arranged so that they can slide laterally inside the longitudinal walls of the casing 1, in order that they may be moved together with the discs and gear wheels mounted upon them, relatively to the shaft 2 and the spindles 4 and 6, as also to the discs and gear wheels mounted upon the latter. In order to facilitate the lateral movement, the spindles 3, 5 are provided with handles or knobs 14 at one end, whereas at the opposite ends which are provided with a collar, a bolt or lever 15, mounted outside the casing, is provided for holding the spindles in position when the gear wheels are in mesh.

The setting of the type carriers or discs 8 is effected by keys 17 guided in the cover of the casing 16, the upper ends of these keys 17 being provided with a push button 18 whereas their lower ends carry the pawls 19 which, when the keys 17 are pressed down, engage the gear wheels 9 of the discs 8, thereby turning them step by step. The keys are returned into the upper limiting position every time after having been pressed down, and are held in this position by means of the springs 20. The distance through which the pawls 19 travel is such that every time the push buttons 18 are pressed down, the disc 8 operated by any particular button is moved over by one letter-type. The pawls indicated in the drawing only permit of a rotation of the discs 8 in one direction but this switching mechanism may, of course, also be arranged in such a way that the discs may be turned either in one or the other direction. Spring catches 21 engage the gaps between the gear teeth of the gear wheels from below, thus locking the discs 8 in the position once taken up, without however, impeding their further operation.

The gear wheels 10 of the discs 8 mounted on the spindle 3 as also the gear wheels 12 on the driving shaft 2 are not clogged regularly all over, but their rims are provided with interruptions in the spacing of the gear teeth, the length and disposition of these gear interruptions being different on the various gear wheels. By this arrangement the discs mounted on one common spindle, *i.e.* in a row adjacent to each other, are turned through different angles during the rotation of the driving shaft 2 so that each one of the discs 8 arranged side by side, is placed in a different position.

Above the discs 8 four rows of windows 65 are provided in the casing 16 through

which the letter types which happen to be on top of the discs 8, become visible. Outside the casing, along one longitudinal wall, markings 23 have been provided adjacent to the crank, which serve as indicators for the initial position of the crank and for the amount through which the crank is turned.

The row of discs mounted on the spindle 3 serves for setting the key or pass-word, which preferably contains as many letters as there are discs on this spindle whereas the rows of discs on the spindles 4, 5, and 6 serve for the adjustment and transcription of the message to be transmitted.

The transcription of plain language into the secret code is effected in the following manner.

After the gear wheels of all the discs have been disengaged by an axial movement of the spindles 3 and 5, the password previously agreed upon is set at the discs of the spindle 3 by these discs being turned by means of the keys 17 and the pawls 19 until the corresponding letters appear in the windows 22. Now, the message to be transmitted in plain language, consisting of words, phrases, and numbers is set on the discs 4, 5, and 6. This is effected by the discs being turned by means of the keys 17 and the pawls 19 until the desired sequence of letters and numbers appears underneath the respective windows. By moving the spindles 3 and 5 in the opposite direction all gear wheels are now brought back into mesh, whereupon crank 7, which previous to the re-engagement of the gear wheels had been placed into a pre-arranged initial position, is turned through a certain angle or a number of times previously agreed upon. In this manner the discs 8 of the spindles 4, 5 and 6 are subjected to an irregular adjustment through the intermediary of the interrupted spur rims of the gear wheels 12 and 10, so that a senseless sequence of letters and numbers appears below the windows 22, which constitutes the desired secret code. This is transmitted to the receiver of the message.

The de-cyphering of the secret code, *i.e.* its transcription into plain language, is effected by means of an identical machine in the following manner:

First all gear wheels are disengaged by an axial movement of the spindles 3 and 5, whereupon the crank 7 is moved into the pre-arranged initial position and the password previously agreed upon is set by the row of discs on the spindle 3. After the gear wheels have been brought to mesh, the crank 7 is moved through the pre-arranged angle or turned as many times as has previously been agreed upon, and all gear wheels are again disengaged

by the lateral movement of the spindles 3 and 5. Now the sequence of letters and signs of the secret code message is set by the type discs on the spindles 4, 5 and 6.

5 After all gear wheels have been brought into mesh again, the crank 7 is returned into its initial position, whereby the type-discs of the spindles 4, 5 and 6 are moved by the same amount but in opposite direction to the movement effected during the transcription of the plain language message into secret code. Thereby the orderly sequence of letters and signs of the plain language message is caused to appear below the windows 22 of the discs 8 on the spindles 4, 5 and 6 in place of the senseless sequence of letters and signs *i.e.* the message may be read off in plain language through the windows 22.

20 The de-cyphering of the secret code, as is obvious, is only possible to a person possessing a machine which is identical with that of the sender of the message and who, moreover, knows the pre-arranged initial position of the crank, as also the angle through which the crank is to be turned or the number of revolutions, and finally, the key or pass-word previously agreed upon. In this manner, the unauthorised de-cyphering of the message even by a person in possession of a machine, is rendered absolutely impossible.

35 As with the device disclosed in Figs. 1 to 3, the discs placed one behind the other on the spindles, 4, 5, and 6 are turned through the same angle every time for a complete rotation of the mutilated gear wheels 12, it will be necessary, in order to avoid the danger of a possible de-cyphering of the secret code by means of the regularly recurring types and signs, to choose at least on the discs of the spindles 6 a sequence of letters different from that on the discs of the spindles 4 and 5. The sequence of letters on the discs of the spindles 4 and 5, however, may be the same, as these discs, although being turned the same amount, are turned in opposite direction. In the same manner the sequence of letters on the discs placed side by side on a common shaft may be the same, as each one of these discs placed side by side in one row is moved through a different angle. There is, consequently, a maximum degree of security against unauthorized de-cyphering of the secret message, as it never happens that certain signs of the secret code correspond to equal signs in plain language.

60 However, in order to permit of turning the discs placed in one row one behind the other, each through a different angle, the discs mounted on spindle 4 may be coupled to those on spindle 5, and the

latter again to those mounted on spindle 6, through the intermediary of spur gears, the toothed rims of which are irregularly interrupted as is the case with the device illustrated in Figs. 4 to 15. For the practical execution of the apparatus it is advisable in order to avoid mistakes in transcribing the messages, to make provision for preventing an unintentional turning of the driven wheels and of the type discs connected thereto, whenever they are not taken along by the driving gears owing to the interruptions in the spur rims. These provisions may be of a nature as described in the second example.

The arrangement intended for practical use is represented in Figs. 4 and 5 in longitudinal cross section,

Fig. 4 showing the gear wheels in mesh with each other whereas

Fig. 5 represents the same gear wheels disengaged.

Fig. 6 is a plan view,

Figs. 7 and 8 disclose the cutting-in and out devices, respectively, of the gear mechanism in two different positions, whereas

Figs. 9 to 12 show the gear mechanism of several type discs, one behind the other, in side elevation and top view, in two different angular positions of the wheels, respectively.

Figs. 13 and 14 are a longitudinal section through part of the machine, as also a plan view from above, respectively, with the operating mechanism disengaged.

Fig. 15, represents the progressive connection or adjustment, respectively, of the type carriers or discs.

In the arrangement disclosed in Figs. 4 to 15, 1 again represents the casing of the machine, in which the shaft 2 and five spindles 3, 4, 5, 6 and 24 are arranged in parallel, one behind the other. The shaft 2 serves as the driving shaft; at its one end protruding from the casing through the slot 60, it carries the hand-crank 7, whereas on each of the spindles 3, 4, 5, 6 and 24 an equal number of type carriers or discs has been arranged in such a manner as to turn loose on the spindles, but immovable laterally. Each disc is rigidly connected to two gear wheels 25, 26 one of which (25) is provided with a full toothed spur-rim whereas the other one, 26, has an interrupted toothed spur rim, *i.e.* one provided with irregular groups of teeth. The full and the interrupted gear wheels fixed to the discs 8 placed one behind the other, are shifted in their respective positions relatively to each other so that for instance, on spindle 3 the full spur gears 25 are placed to the right, and the inter-

rupted gear wheels 26 to the left of the discs 8. On the spindle 4, however, the interrupted gear wheels are placed to the right and the full gear wheels to the left of the discs 8, and so on. In this way, one full gear wheel will always be opposite an interrupted one. The gear wheels are not in direct mesh with each other but are coupled by means of pinions 32 mounted rotatably on the intermediate spindles 27, 28, 29, 30, 31 but in a manner that they cannot be shifted laterally. The pinions placed one behind the other in the longitudinal direction of the machine are arranged alternately to the right and to the left of the discs (Fig. 10), so that the interrupted gear wheels on spindle 3 may be coupled to the full gear wheels on spindle 4, while the interrupted gear wheels on spindle 4 may be coupled to the full gear wheels on spindle 5, and so on. Gear wheels 33 mounted on the driving shaft 2 mesh with the full gear wheels on the spindle 3. When the crank shaft 2 is turned, the gear wheels 33 drive the full gear wheels 25 of the discs 8 on the spindle 3 which, in turn, by means of their interrupted gear wheels 26, drive the full gear wheels of the discs 8 on the spindle 4 through the pinion 32, and so on. In this manner, not only each of the discs 8 placed on a common spindle side by side is turned through a different angle, but also all discs arranged one behind the other, will be subject to a different angular motion. As only the discs on the spindles 4, 5, 6 and 24 serve for transcribing the message, and the discs on spindle 3 for setting the pass-word, in order to change the initial position of the interrupted gear wheels of these discs, the latter discs may also be turned in common through the same angular distance. Therefore, the gear wheels 33 need not be provided with interruptions such as described in connection with the gear wheels 12 of Figs. 1 to 3, but may be fitted with full spur rims as represented in Figs. 4 and 5.

During the turning of the discs with the object of transcribing the sequence of letters or signs set on the machine into secret cypher or *vice versa*, the pinions 32 are to serve at the same time for locking the driven full gear wheels 25 and therewith also the discs 8 in their respective positions, wherever the pinions 32 by virtue of the interruptions in the toothed rims of the driving gear wheels 26 are out of mesh with the latter i.e. when the driving gear wheels are running idle. To this effect one half of the face of the pinions 32 is provided with full teeth, whereas on the other half of the face, each second tooth has been removed.

(Figs. 9—12). This means that these pinions are provided, so-to-say, with two rows of teeth corresponding as regards the position of the teeth, one of which only possesses half as many teeth as the other. At the places where the toothed rims of the driving gear wheels 26 are interrupted, segments 34 have been provided, connecting the groups of teeth, and forming a continuation of the pitch circle. These segments extend over the part of the face of the tooth opposite that half of the pinion 32 which only possess half the number of teeth. As long as one group of teeth of the driving wheels is in operation (Figs. 9 and 10) both toothed rims of the pinion mesh with the driving wheel 26, as also with driven wheel 25. Whilst the driving wheel 26 is running idle, i.e. when the pinion is placed opposite an interruption in the toothed rim of the latter, the segment connecting the groups of teeth of the driving wheel engages the gap provided on one half of the pinion by omitting every other tooth (Figs. 11 and 12); thereby the pinion is prevented from turning. As, however, the pinion meshes permanently with the neighbouring full gear wheel, this latter is likewise locked together with its respective disc, while the driving wheel is running idle, whereby mistakes in the transcription of a sequence of letters or signs due to an unintentional movement of one of the discs, are effectively guarded against. Moreover, the locking of the pinions assures at all times the correct re-engagement of the gear teeth of the interrupted wheels, both during the forward movement of the latter as also during the reverse rotation.

The cutting-out of the gear mechanism is not accomplished by an axial movement of part of the spindles but by a shifting of the spindles in transverse direction. To this effect the spindles 3, 4, 5, 6, 24 are each supported not in the walls of the casing, but in carriages comprising each a pair of laterally disposed cheeks 36 which are guided in grooves 35 provided in the longitudinal walls of the casing 1. These cheeks 36 at the same time carry the spindles 27, 28, 29, 30 and 31, the arrangement being such that each one of the spindles 3, 4, 5, 6, 24 is attached to one pair of checks, together with the spindles 27, 28, 29, 30, and 31 located behind the former. Except for the cheeks carrying the spindles 5 and 29 which are held in a fixed position on the walls of the casing each pair of cheeks is connected rigidly together by means of the spindles, as also by a number of transverse tie-rods (not shown in the drawings), thus forming a sliding frame or carriage which may

be moved in longitudinal direction of the casing in such a way as to allow the sets of gears being brought out of engagement by shifting the pairs of cheeks in opposite directions. This shifting of the pairs of cheeks is effected by the aid of two slide rods 37, guided in slots in one of the longitudinal walls of the casing (Figs. 7 and 8). The innermost ends of these slide rods carry rollers 38 which engage in radial slits 39 of a crank or eccentric disc 40 supported along the wall of the casing. This disc 40 may be turned by means of a hand crank 41 connected thereto. The slide rods are provided with holes 42 and with longitudinal slots 43 which engage pivots 44 (Fig. 13) provided on the sliding cheeks. The pivots of the cheeks carrying the spindles 4 and 6 engage the slots 43; the pivots of the cheeks carrying the spindles 3 and 26, however, engage the holes 42. If the disc 40 is turned in counter-clockwise direction (Fig. 8), the two pairs of cheeks containing the spindles 3—27 and 24—31 are carried along first, and after the latter have moved through a certain distance, the pairs of cheeks containing the spindles 4—28 and 6—30 are carried along, *i.e.* the pairs of spindles located in front and behind the fixed spindles 5—29 are moved away from this latter pair of spindles as also from each other in opposite directions. In this manner all pinions 32 have been brought out of engagement with the full gear wheels 25 placed behind, thus uncoupling the discs 8 located one behind the other (Figs. 5 and 13). The coupling-up of the system of gears is effected by the opposite rotation of the disc 40, whereby the spindles are moved in the opposite manner to what had been done before, until all gear wheels are again in mesh. The driving shaft 2 may likewise be supported in a pair of cheeks which may slide in longitudinal direction inside the casing 1. However, it may also be supported in the pair of cheeks carrying the spindles 3 and 27, as represented on the drawing, the unclutching of its gear wheels from the gears 25 of the spindles 3 being in this case affected by a movement of the driving shaft 2 in axial direction. For preventing an unintentional turning of the type discs whilst the gear wheels are unclutched, the discs 8 are locked by means of springs 45, pressing against them from below. (Figs. 2 and 13.) The springs 45 are preferably fastened to shafts 46 resting in the respective pair of cheeks 26 and carrying each one control lever 47, which is acted upon by a pusher-rod 48, one end of which is linked to the lever 47, the other end being attached to the casing 1. The arrangement of the

pusher rods in this case is such that during the movement of the pairs of cheeks with the object of uncoupling the system of gears, the springs 45 are pressed against the type-discs 8 by turning the shafts 46. During the opposite movement of the cheeks with the object of re-engaging the system of gears, however, these springs are moved away from the discs 8, *i.e.* put out of action.

The windows 22 are provided in the rails 49 connecting the pairs of cheeks 36 on top, these rails taking part in the movement of the spindles. Owing to the arrangement of the intermediate gear wheels 32 it is possible to make the type discs 8 as large as, or even larger than the gear wheels 25, 26 in order that the types may be placed close below the windows, so that the type or letter which happens to be on top is directly below the window. For closing the spaces remaining between the rails 40 covering laths 50 extending over the edges of the rails 40, have been provided which are fastened to the walls of the casing 1 in such a way as not to impede the movement of the rails 49 during the connection and disengagement of the system of gears.

For rotating any individual type disc 8 in order to see the pass-word and the message to be transmitted, keys 17 have again been provided which have push buttons 18 fitted to the tops. With the arrangement according to Figs. 4—15 the lower, off-set ends of these keys are guided in vertical holes provided in flat rods 51, connecting the cheeks 36, 36 of each pair of cheeks, whereas they are guided on top, on the spindles 27, 28, 29, 30, 31 by means of longitudinal slits 52. In order to permit of turning the type discs 8 backward as well as forward, the keys 17 carry two pawls 19 and 19^a arranged in opposite directions relatively to one another, one of which (19) engages the full gear wheels 25 from the top, the other one from below. The keys 17 may be pressed down or raised by means of the buttons 18. As a rule they are kept midway between the top and bottom position by means of a two-legged spring 53 attached to a rod 54 connecting the two cheeks 36, 36 and supported in its half-way position inasmuch as the legs of the spring 53 press from above and below against a pivot 56 attached to the key 17. The switching pawls 19 and 19^a, which are again acted upon by springs 57, 57^a are supported in the half-way position of the key 17 by means of transverse rods 58, 58^a so that in this position they cannot engage the teeth of the gears 25. If, however, the key 17 is either raised or lowered, one or the other of the pawls 19

and 19^a will slide either above or below the rod 58 or 58^a, thus engaging the gear teeth of the gear wheel 25 whereby this gear wheel and the respective disc 8 connected thereto are switched round by one type in one or the other direction. A separate operating device is provided for each type disc.

The operation of the device according to Figs. 4 and 5 is essentially the same as with the arrangement according to Figs. 1 to 3. After the system of gear wheels has been uncoupled in the manner already described, the discs 8 on the spindle 3 are first adjusted for the pass-word selected; whereupon on the spindles 4, 5, 6, 24 the plain-language message to be transcribed, is set. After the system of gears has been brought back into mutual engagement, the crank 7 is given a pre-arranged number of turns, thus effecting the conversion of the plain language message into secret code. The decyphering of the message also takes place in the manner described in respect of the example illustrated in Figs. 1 to 3. As the crank shaft 2 carried full gear wheels, a distinct initial position of the crank shaft is not required; only the number of turns of the crank and the pass-word need previously be agreed upon. Also in this case the security is very great, as by the adjustment of another pass-word at the discs of the spindle 8 the initial position of the driving gear wheels 26 on this spindle may be changed in any desired manner whereby, in combination with the selection of a different number of turns of the crank, an infinite number of variations is rendered possible. The arrangement of the types or letter signs may be the same on all the discs, as also those discs located one behind the other are each turned through a different angle.

Of course this invention is not confined to the arrangements illustrated by way of example. There are many other combinations possible in which this invention may be carried into effect without departing from the spirit of my invention. More especially, the machine may be provided with a printing device in order to permit of printing the message directly in plain language, as also in cypher-code, as may be desired.

I am aware that it has been proposed, in cyphering machines whose mode of operation differs from that of the present machine, in one case, to provide independently rotatable cyphering members, such as tables, plates or drums, which could be coupled by adjustable gearing to a common shaft, and, in another case, to provide two parallel rows of independently rotatable cyphering discs

each fast on a toothed wheel and so mounted that after the independent adjustment of the discs axial shift of one row couples the two rows, and I therefore make no claim to either of these arrangements, *per se*.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A cyphering machine wherein whole words or entire phrases of the open language or a continuous sequence of letters or signs of the secret code are or is first set and then transcribed as a whole into the secret or *vice versa* into ordinary language, this being effected by the provision of a number of type carriers (*e.g.* letter-carrying discs) which are arranged side by side and one behind another in a number of rows and which, on the one hand, can be rotated independently of one another in order to set the sequence of letters to be converted, and, on the other hand, can be coupled with a common driving spindle by means of gear wheels fast on said carriers in order to change the sequence of letters by commonly rotating the type carriers, the rotation of the type carriers being effected by means of gear wheels which are provided with interruptions in the spacing of the gear teeth (*e.g.* irregular gaps among the teeth) differing on different wheels, in order to displace the type carriers through different angles.

2. A cyphering machine according to Claim 1, characterised by this, that between the type carriers serving for conversion of the sequence of letters and the common driving spindle, a further row of rotatable type carriers is arranged, each of which is provided with a fully toothed wheel and a gapped toothed wheel and which, on the one hand, may be adjusted independently of one another to exhibit a pass or key word, and, on the other hand, may be coupled by means of their fully toothed wheels to the gear wheels of the driving shaft and by means of their gapped toothed wheels to the gear wheels of the said type carriers for word-sequence conversion.

3. A cyphering machine according to Claims 1 and 2 characterised by the type carriers which are arranged one behind another being coupled together by means of fully toothed wheels and by the type on said carriers being arranged in varying sequence.

4. A cyphering machine according to Claims 1 and 2, characterised by a number of the spindles which carry the type carriers being displaceable axially, in order to put the gear wheels out of mesh

for the purpose of adjusting the type carriers.

5 A cyphering machine according to Claims 1 and 2, characterised by the type carriers which are arranged one behind another, being coupled together by means of pairs of gear wheels, each pair consisting of a fully toothed wheel and a gapped toothed wheel, in order to be able to shift
10 through different angles not only the type carriers arranged side by side but also those arranged one behind another.

6 A cyphering machine according to Claims 1, 2 and 5, characterised by the,
15 in part, fully and, in part, gapped toothed wheels of the type carriers arranged one behind another being coupled by means of intermediate wheels which on one half-width of their rims have only half the
20 number of teeth existing on the other half, the groups of teeth on the wheels with interrupted teeth being connected by means of segments which constitute a continuation of their addendum-circle and
25 extend over half the width of the wheel and which, during idle operation of the gapped wheels, engage in gaps in the pinions and thereby safeguard from turning both the intermediate wheels and the
30 fully toothed wheels meshing with them.

7 A cyphering machine according to Claims 1 and 2 characterised by the spindle of the type carriers being located in frames or slides shiftable transversely
35 to said spindles, so that, by transversely shifting the frames or slides, the gear coupling the type carriers may be disengaged.

8 A cyphering machine according to
40 Claims 1, 2 and 6, characterised by the slides containing the spindles of the type carriers being displaced by means of two slide rods which are shiftable in either direction by means of a crank disc provided in part with apertures and in part
45 with longitudinal slots, the latter being engaged by pins mounted in the slide or frame.

9 A cyphering machine according to

Claims 1, 2, 6 and 7, characterised by 50 windows being formed in slidable portions of the casing cover, which portions are connected to the frames or slides journalling the type carrier spindles and share the displacement of said frame. 55

10 A cyphering machine according to Claims 1 and 2, characterised by the type discs being each adjusted by means of a vertically reciprocable key rod, which by means of a two-armed spring is held at
60 middle height and carries two pawls operating in contrary directions and disengaged in the middle position of the key rod, which pawls may be put into engagement with the full gear rim of the type
65 carrier by depressing or elevating the key rod as required, in order to feed said gear in one direction or the other.

11 A cyphering machine according to Claims 1 and 2, characterised by this, that
70 when the pass word and the sequence of letters for conversation have been set the type carriers are held secure against accidental rotation by means of brake-springs, which are mounted on a common
75 spindle for each row of discs, this spindle being journalled in the slide or frame containing the particular spindle for the type carriers and being controlled by means of a control lever and a thrust rod secured to
80 the casing of the machine at the time the frame or slide is displaced, the control being such that when the gears are disengaged the brake springs are pressed against the type carriers, and when the
85 gears are re-engaged said springs are thrown out of action.

12 A cyphering machine, constructed or operating substantially as described, with reference either to Figs. 1—3 or
90 Figs. 4—15 of the accompanying drawings.

Dated this 14th day of July, 1921.

CLEMENT LEAN, B.Sc.,

A.M.I.Mech.E.,

Chartered Patent Agent,

Thanet House, 231, Strand, London,
W.C. 2.

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Fig. 1

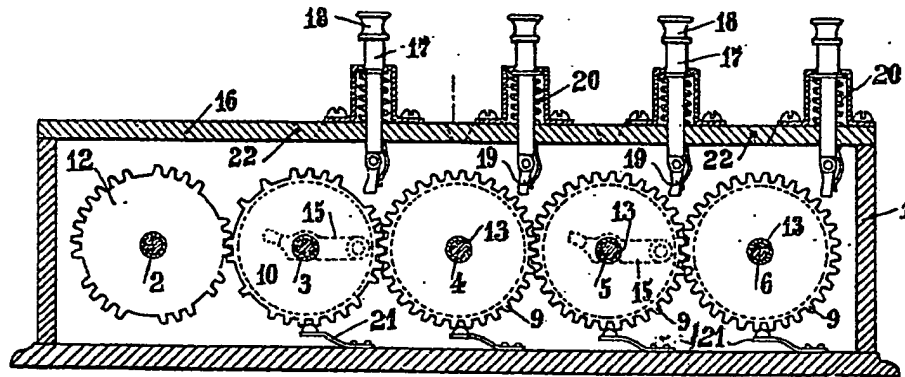


Fig. 2

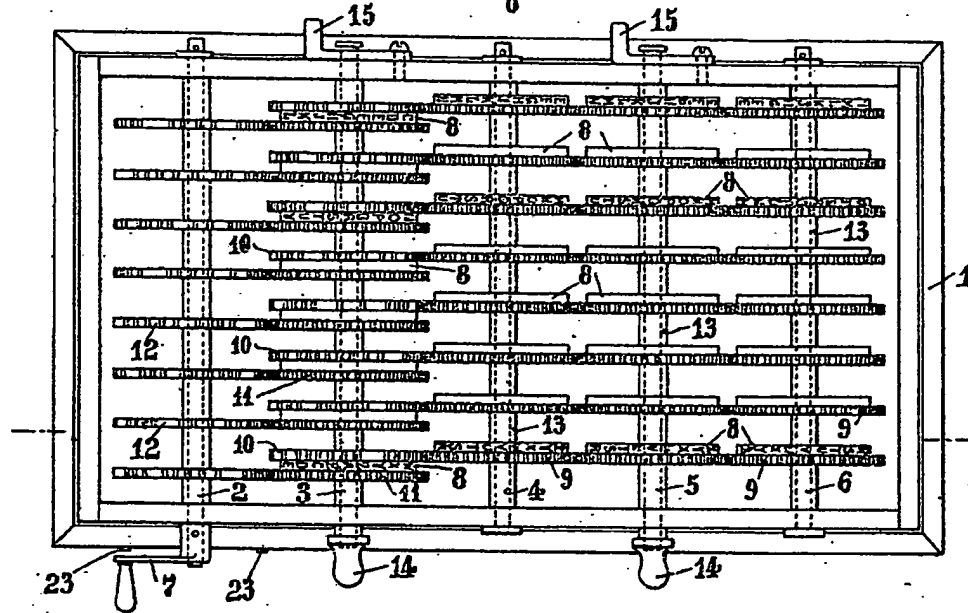
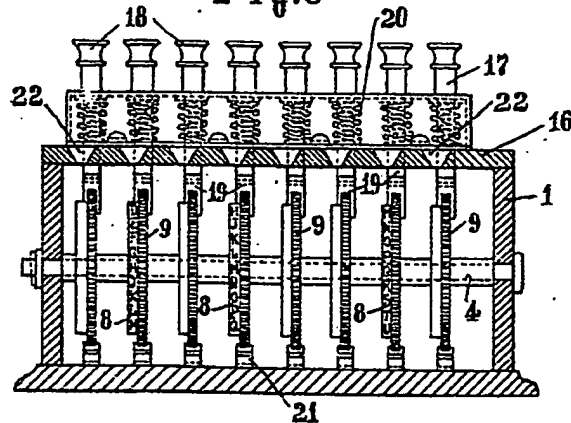


Fig. 3



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Fig. 4

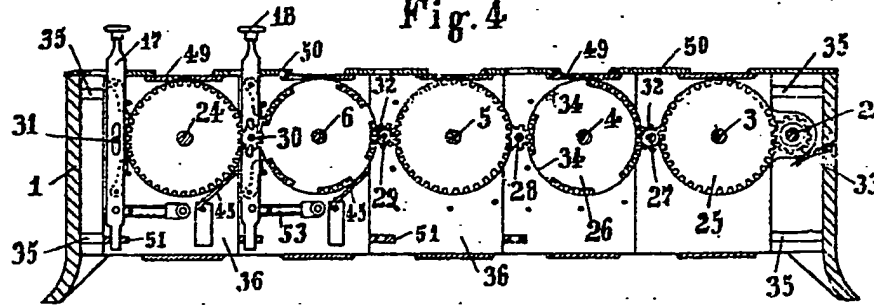


Fig. 5

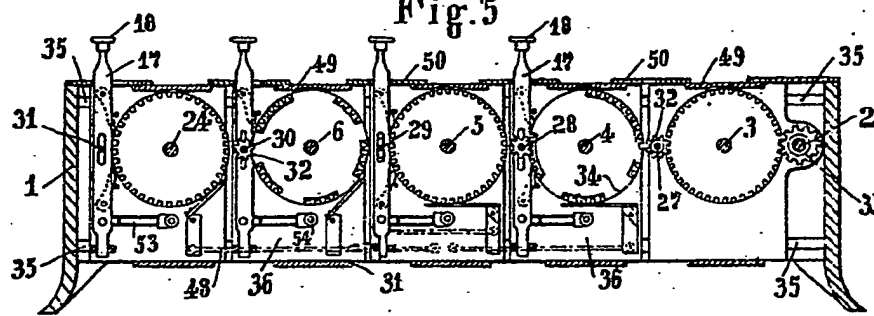
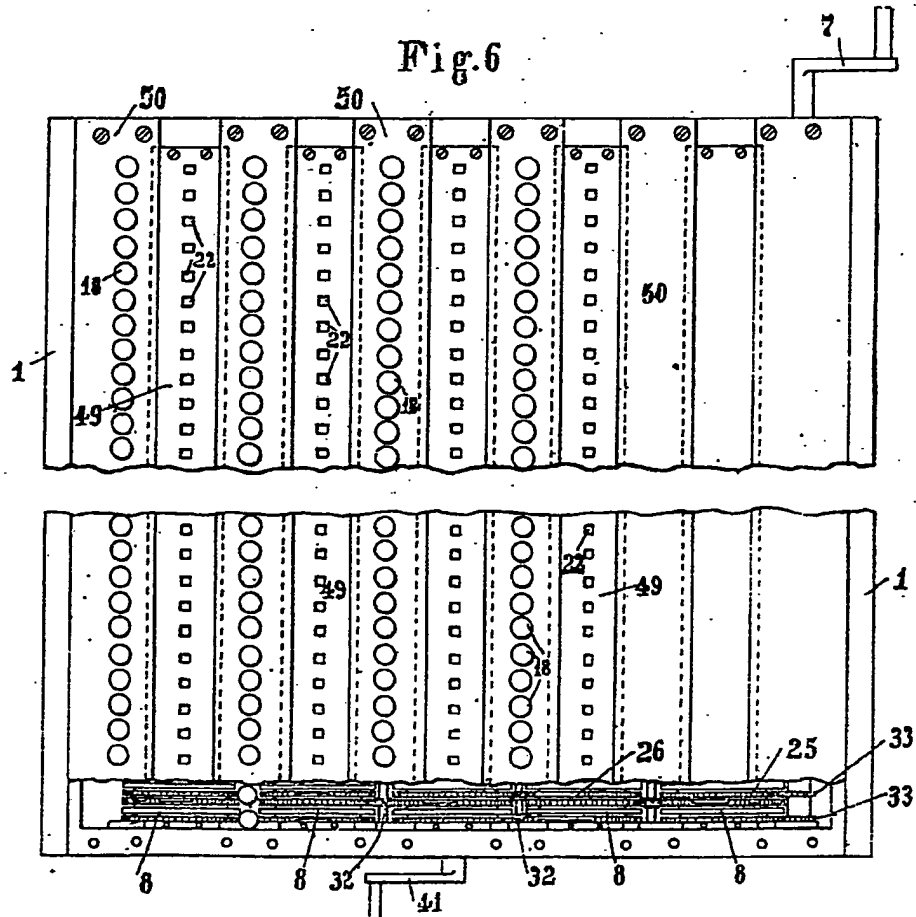
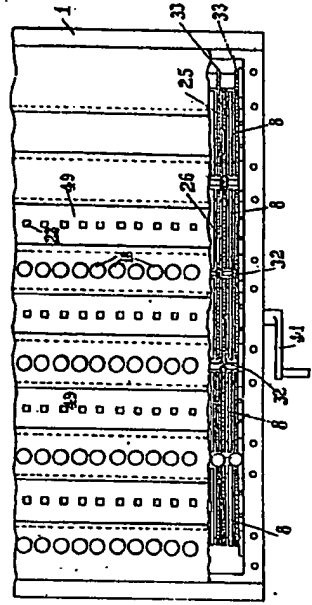
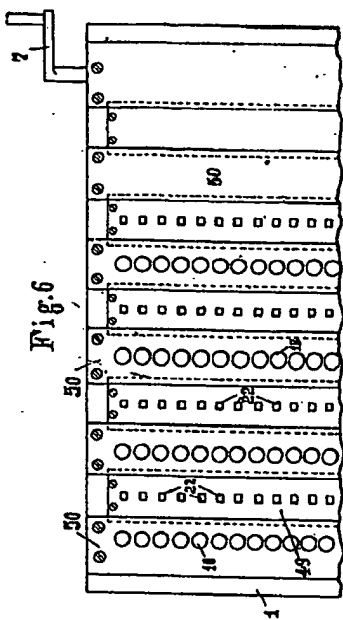
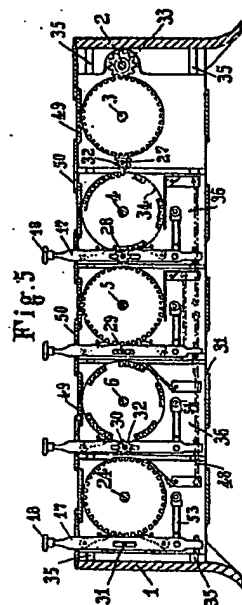
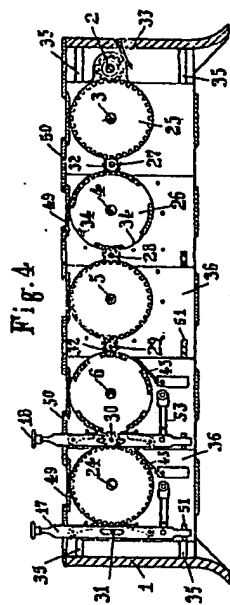
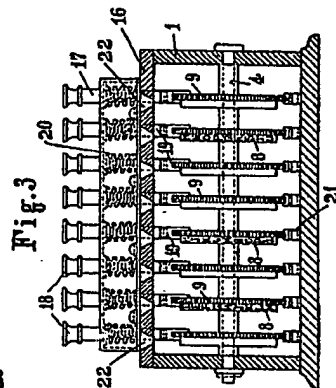
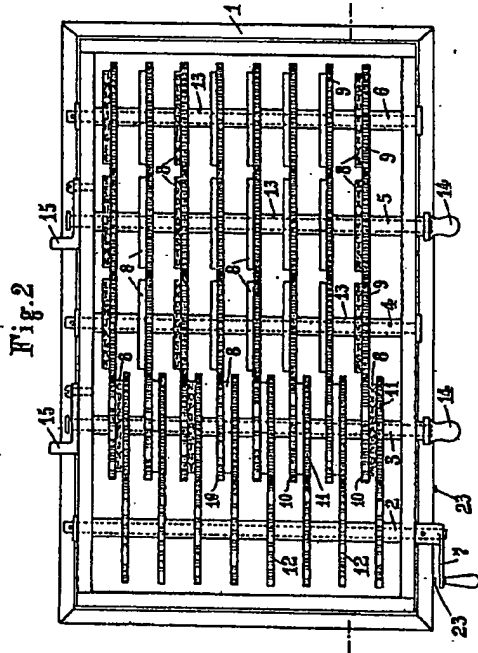
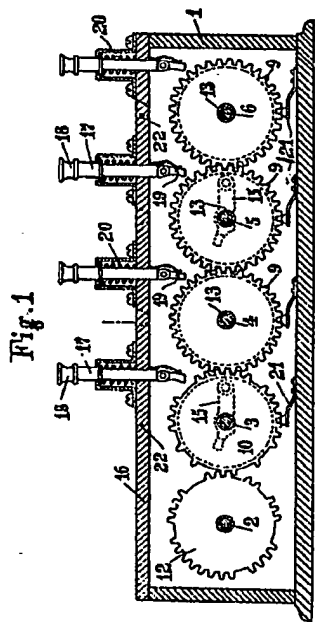


Fig. 6





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Fig. 7

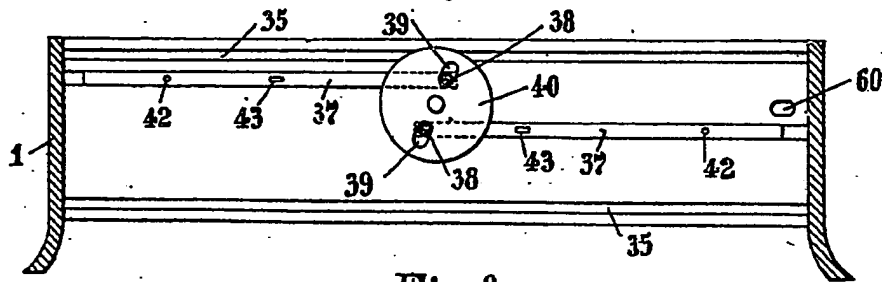


Fig. 8

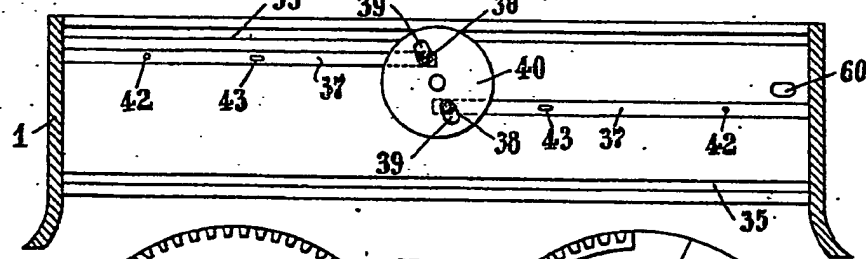


Fig. 9

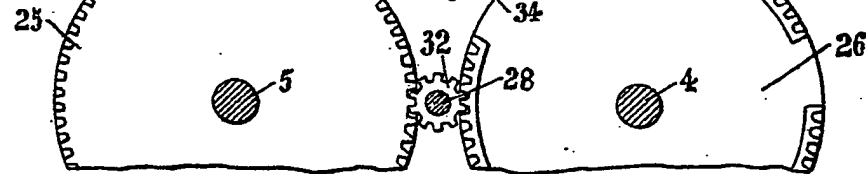


Fig. 10

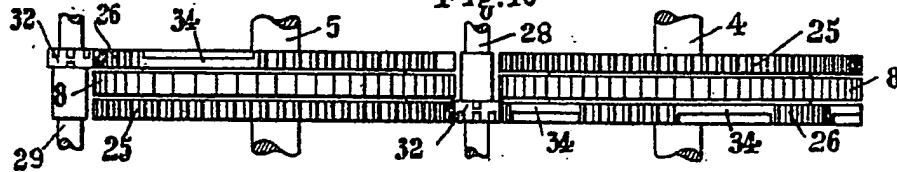


Fig. 11

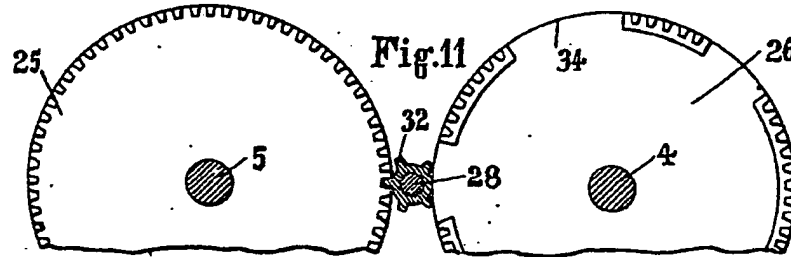
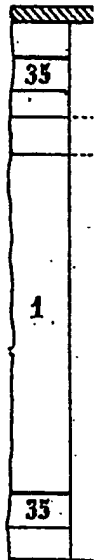
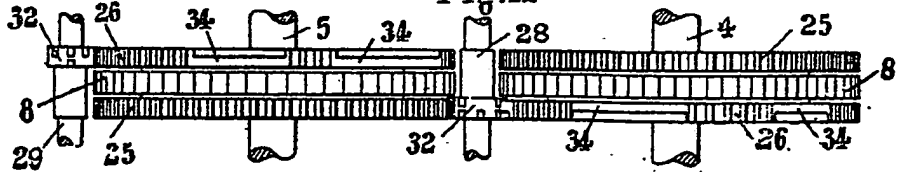


Fig. 12



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Fig. 13

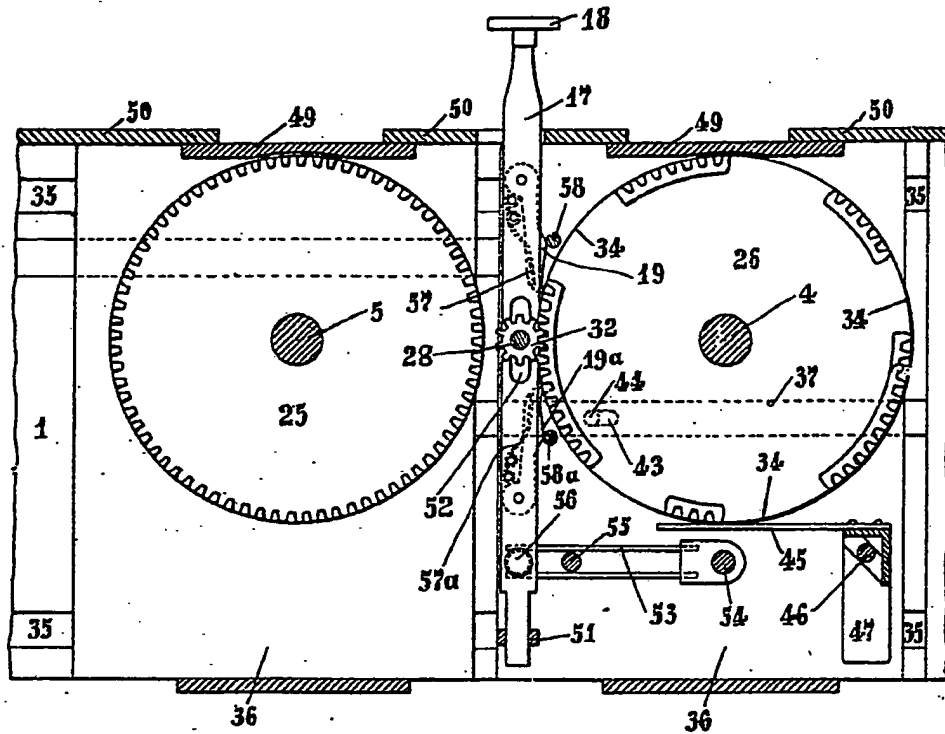


Fig. 14

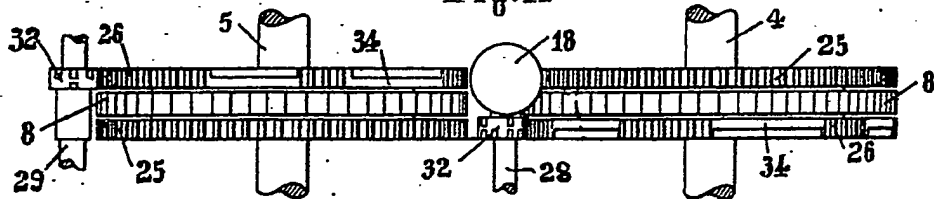
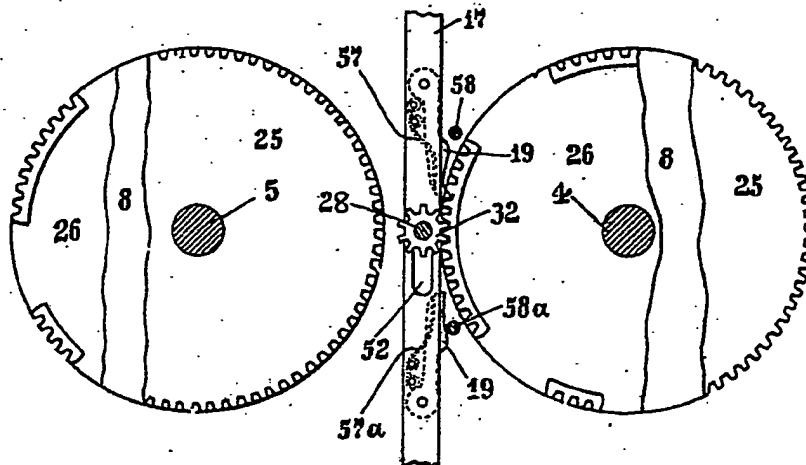
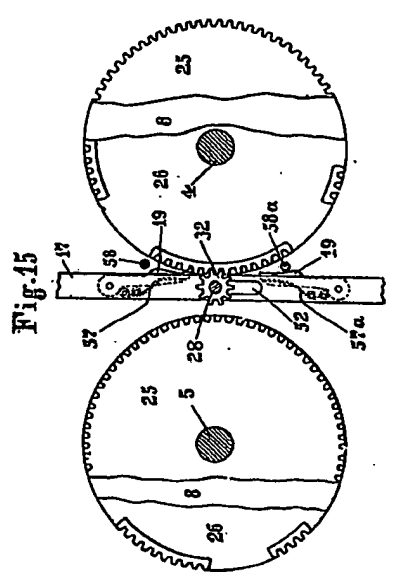
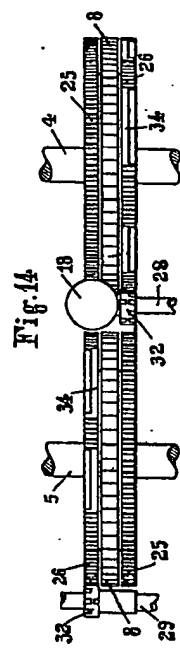
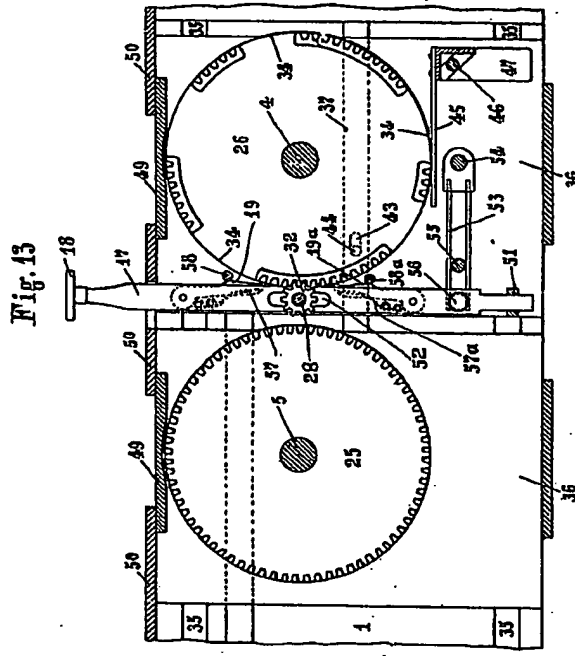
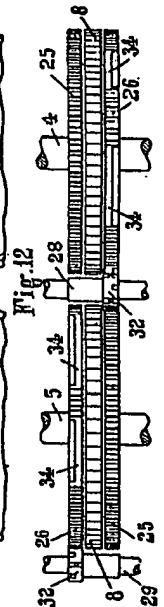
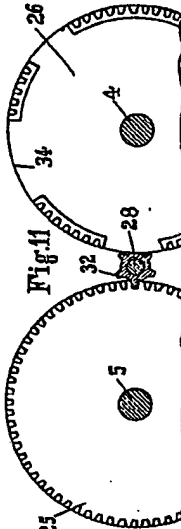
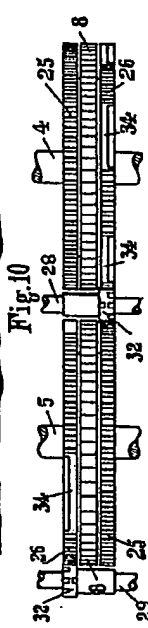
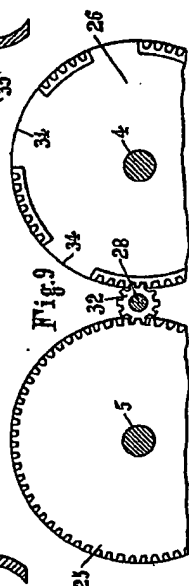
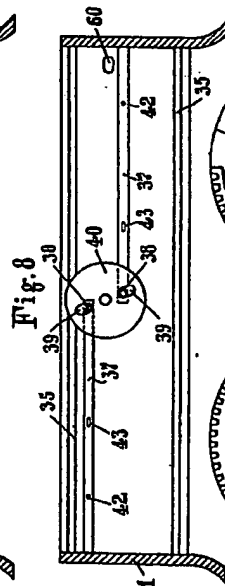
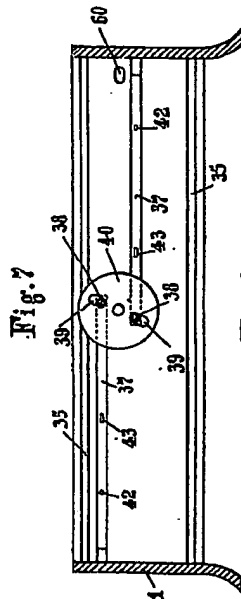


Fig. 15





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